

V.—This area probably appeared as the secondary effect of a large depression central south of Newfoundland.

VI.—This area reached the New Jersey coast on the 15th, passing thence eastward out to sea.

VII.—Developed over the middle plateau on the 13th and 14th, and moved thence northeastward over Montana to the Saskatchewan Valley where on the 16th it changed its course to the eastward and on the 17th to the southeastward, passing over the upper lakes, where on the 18th it joined with number viii over Lake Huron.

VIII.—This area developed in southern Dakota on the 17th as a secondary depression to number vii, then central in Manitoba. During the day it moved southward into Nebraska and thence eastward to the upper lakes, where on the 18th it joined with number vii over Lake Huron.

IX.—This area developed in west Kansas on the 18th, was central in northern Texas on the 19th, and moved thence eastward with diminishing energy to the Carolina coast, where it disappeared on the 22d.

X.—Developed in the Saskatchewan Valley on the 19th and moved rapidly eastward along the northern border of the country, passing the upper lakes on the 21st and reaching the Gulf of Saint Lawrence on the 23d.

XI.—This area developed over the middle plateau on the 21st and 22d and moved slowly eastward to the Missouri Valley, where on the 25th it joined with number xii in eastern Kansas.

XII. This area combined with number xi in Kansas on the 25th, and thereafter moved eastward as one depression, reaching the New Jersey coast on the 27th. On the 28th the depression disappeared south of Nova Scotia.

XIII.—Developing on the 24th north of Montana, this area moved slowly eastward, just north of the United States, reaching the lower Saint Lawrence valley on the 30th.

XIV.—This area sub-divided on the 31st, forming two centres of diminished energy, one being in Manitoba and the other in southern Dakota. It seems probable that these two centres joined in Minnesota in one depression on the following day.

#### NORTH ATLANTIC STORMS FOR JULY, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during July, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Seven depressions have been traced for July, 1889; the average number traced for the corresponding month of the last six years being seven and one-half. Of the depressions traced for the current month, three, numbers 3, 4, and 5, were continuations of areas of low pressure which first appeared over the North American continent; three are first charted over mid-ocean in high latitudes, and one apparently originated northeast of the Banks of Newfoundland. The movements of the depressions over the western part of the ocean were irregular, which fact may be attributed to the abnormally high pressure which prevailed during a considerable portion of the month to the east and southeast of the Banks of Newfoundland. No depressions with well-defined movements of translation appeared within the region of observation over the more southern portions of the ocean, the Gulf of Mexico, or the Caribbean Sea. Under date of July 23d, the Rev. Benito Vines, of the Belen College Observatory, Havana, Cuba, reports as follows: "Since Sunday, 21st, there have been observed indications of a cyclone in the first quadrant. This hurricane is moving in the beginning of its trajectory in the longitude of the Bahamas, in a direction toward the New Channel, in the vicinity of which it will probably recurve." The following dispatch was sent to the New York Herald from the City of Mexico, via Galveston: "July 12th, a terrific storm is raging at Vera Cruz, and the shipping there is in great peril. The Spanish bark 'Hijas de Vinas' is dragging her anchor. The officers of the Mexican man-of-war 'Libertad,' which is lying in the roadstead exposed to the whole fury of the gale, are doing all in their power to save their ship. Her anchorage is very insecure." Over the western portion of the ocean, north of the thirty-fifth parallel, fresh gales prevailed from the 5th to 17th, and 20th to 26th, attaining the force of strong gales on the 10th, 11th, and 15th to 17th, when the barometric pressure fell to about 29.50 (749). Over mid-ocean the stormy periods were embraced between the 1st to 9th, 17th to 20th, 23d, 24th, and 29th to 31st, strong gales being reported from the 5th to 8th, 17th and 18th, and the lowest barometric pressure, about 29.40 (747), on the 4th. Over the eastern part of the ocean, in the vicinity of the British Isles, unsettled weather prevailed from the 7th to 11th, 16th, 19th

to 26th, 30th and 31st, strong gales being reported on the 21st, 24th, and 25th, and barometric pressure falling to about 29.40 (747) being noted on the 24th.

Compared with the corresponding month of previous years the storms which appeared over the north Atlantic Ocean during July, 1889, corresponded closely in number with the average; they were deficient in energy, and pursued irregular paths, more especially over the western part of the ocean. A noteworthy feature of the month was the absence of storms of tropical or subtropical origin advancing northward over or east of the United States. The storms traced over the north Atlantic for July in preceding years varied in number from five in 1884 to twelve in 1886. The storms of the middle latitudes of the north Atlantic Ocean seldom acquire great strength in July, the most destructive storms of the month generally appearing in the tropical or subtropical regions. Among notable West-Indian storms for July described in the REVIEW during the last six years were those of 1886 and 1887. The hurricane of 1887 advanced from Barbadoes Island westward over the Caribbean Sea and thence northward over the Gulf of Mexico to the east Gulf states from the 20th to the close of the month. This storm was very severe at Barbadoes Island on the 20th, and several vessels were wrecked. Several vessels were wrecked on the west coast of Florida and the north Cuban coast, and very heavy rainfall in the Gulf States, in connection with high winds and swollen rivers, caused great destruction to the growing crops and the public highways. In 1886 two storms advanced northward from the vicinity of Cuba, neither of which were very destructive in their character.

The following are brief descriptions of the depressions traced for July, 1889:

1.—This depression was central over mid-ocean in about latitude N. 54° on the 1st, with central pressure falling to about 29.70 (754), and moderate to fresh gales, whence it moved northeasterly and disappeared north of the region of observation after the 2d.

2.—This depression appeared northeast of the Banks of Newfoundland on the 3d, with pressure about 29.60 (752), and thence passed southeast to about N. 47°, W. 38° by the 4th, in which position pressure falling to about 29.40 (747) was reported. By the 5th the centre of depression had advanced southeast to the forty-second parallel, whence it recurved northward to the forty-eighth parallel by the 6th, this movement being apparently due to the combined influence of an area of high pressure to the eastward and southward and the advance from the westward, south of Newfoundland, of an area of low pressure. By the 7th the storm-centre had moved westward to about the thirty-eighth meridian, after which it apparently united with

depression number 3 which moved eastward over the Grand Banks during the 7th.

3.—This depression was a continuation of low area vii-viii, and on the morning of the 7th was central south of Newfoundland, with pressure about 29.70 (754), and fresh gales from Nova Scotia to the Banks of Newfoundland. By the 8th the depression had moved rapidly eastward and was central in about N. 47°, W. 31°, with pressure about 29.60 (752), and fresh to strong gales. At noon, Greenwich time, of the 9th the storm-centre had advanced to the south of the British Isles, after which it passed east or northeast beyond the region of marine reports.

4.—This depression was a continuation of low area v which passed from near Cape Breton Island, where it was central on the 8th, southward to about the thirty-ninth parallel by the 9th, where central pressure about 29.65 (753) was shown. During the next twenty-four hours the depression changed its position but slightly, a marked decrease in pressure was, however, shown, and the attending winds increased to the force of strong gales. By the morning of the 11th the storm-centre had recurved northward to the forty-fourth parallel, the recurve being apparently occasioned by the presence to the eastward and southeastward of high barometric pressure. Remaining nearly stationary off Nova Scotia and Cape Breton Island until the 12th, the centre of depression is thence traced to southern Newfoundland by the 13th, after which it passed to the north of the Grand Banks by the 14th, and thence recurved southwest and united on the 15th north of Newfoundland with low area iv, which had advanced from the westward. By the 16th the centre of depression had moved westward and was located east of Anticosti Island, Gulf of Saint Lawrence, whence it passed eastward over Newfoundland and united on the 17th northeast of Newfoundland with depression number 5, which had advanced from the southwest. By the 18th the depression had moved north-northeast to the fifty-sixth parallel, and from this position passed eastward, attended by fresh to strong gales, and disappeared over the British Isles after the 20th.

5.—This depression was a continuation of low area vi which advanced eastward from the New Jersey coast during the 15th. By the 16th the centre of depression was located southeast of Nova Scotia, with pressure about 29.50 (749), and fresh to strong gales, whence it moved northeast and united with number 4 northeast of Newfoundland on the 17th.

6.—This depression appeared over mid-ocean in about latitude N. 57° on the 23d, to which position it had apparently advanced from the west or northwest, after which it moved rapidly eastward and disappeared over or north of the British Isles, attended by fresh and strong north to west gales to the forty-fifth parallel until the 26th.

7.—This depression pursued an irregular course west of the British Isles from the 29th to the close of the month, its presence being attended by moderate to fresh gales, and barometric pressure falling to about 29.50 (749) on the 30th.

#### OCEAN ICE IN JULY.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for July during the last seven years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
July, 1883.....	42 42	49 57	July, 1883.....	46 47	45 44
July, 1884.....	46 24	50 02	July, 1884.....	48 36	46 28
July, 1885.....	42 14	48 30	July, 1885.....	48 00	44 00
July, 1886.....	42 59	49 18	July, 1886.....	45 52	34 30
July, 1887.....	43 30	50 05	July, 1887.....	52 04	41 16
July, 1888.....	44 49	47 45	July, 1888.....	47 40	50 10
July, 1889.....	44 49	47 45	July, 1889.....	45 50	40 00

\* Off Cape Race. † An isolated iceberg and some field ice.

In July, 1889, the southernmost ice reported, which consisted

of a solid mass of ice bearing north (true) about ten miles from the position given, was nearly one degree north of the average southern limit, and the easternmost ice noted, a small iceberg, was about four degrees east of the average eastern limit of ice for the month. Ice was most frequently encountered near and east of Belle Isle, and along and off the northeast edge of the Banks of Newfoundland. No ice was reported in the immediate vicinity of southern Newfoundland, nor over the more southern and western parts of the Banks of Newfoundland. Compared with ice reported for June, 1889, the southern limit of Arctic ice for the current month was about two degrees farther north, while the extreme eastern limit was about the same. Compared with the corresponding month of preceding years the ice reported for July, 1889, about equalled the average in quantity, although in its distribution its absence from off southern Newfoundland and over a greater portion of the Grand Banks was unusual.

The following positions of icebergs and field ice reported are shown on chart i by ruled shading:

1st.—N. 52° 44', W. 51° 52', numerous large bergs between this position and Belle Isle; N. 52° 46', W. 50° 46', large bergs five to ten miles apart.

4th.—N. 52° 48', W. 52° 19', Arctic ice, large and small pieces.

5th.—N. 52° 22', W. 51° 05', numerous large and small bergs; N. 52° 37', W. 53° 16', several small bergs; N. 52° 00', W. 55° 10', numerous large and small bergs to Belle Isle; N. 51° 52', W. 54° 32' to N. 51° 56', W. 54° 10', twenty-six moderate and small-sized bergs; N. 52° 06', W. 54° 42', forty large and small bergs.

6th.—N. 47° 45', W. 46° 30' to N. 47° 20', W. 47° 30', five bergs, varying in height from seventy to eighty feet; N. 51° 50', W. 53° 11', a large berg; N. 52° 02', W. 51° 54', two moderate-sized bergs; N. 52° 04', W. 51° 39', a large berg; N. 47° 11', W. 47° 06', a berg with two peaks one hundred and fifty feet high.

7th.—N. 52° 11', W. 51° 15', a very large berg.

8th.—N. 45° 50', W. 40° 00', a small berg.

9th.—N. 47° 04', W. 47° 37', several pieces of ice; N. 46° 52', W. 47° 49', a berg; N. 44° 49', W. 47° 45', a solid mass of ice bearing north (true) about ten miles; from one hundred miles east-northeast of Belle Isle, a large number of bergs.

10th.—N. 47° 46', W. 49° 13', three large bergs; Cape Norman to N. 52° 10', W. 53° 50', ten large bergs.

11th.—N. 47° 21', W. 48° 00', a number of bergs in fog.

12th.—Off Belle Isle, several large bergs; from one hundred miles east of Belle Isle to the straits, a number of large and small bergs.

13th.—N. 51° 05', W. 57° 36', a large berg; off Point Amour, five large bergs.

13-14th.—Point Amour to N. 52° 22', W. 53° 25', several bergs; N. 51° 10', W. 57° 40' to N. 52° 18', W. 53° 44', numerous bergs.

14th.—N. 52° 00', W. 54° 45', two medium-sized bergs, and several bergs from this position through north channel Straits of Belle Isle, with dense fog all the way; off Belle Isle, five large bergs; Straits of Belle Isle to Point Amour, a large number of large bergs; N. 48° 06', W. 47° 14', several bergs and pack ice.

15th.—Two miles off Point Amour Light, two pieces of ice.

16th.—N. 48° 26', W. 49° 37', a rather large berg; N. 47° 40', W. 51° 00', four small bergs.

17th.—N. 48° 05', W. 47° 12', one medium-sized berg; N. 47° 28', W. 46° 29', a large berg with conical peak and projecting shelf; N. 47° 22', W. 45° 56', a very large berg.

18th.—N. 45° 34', W. 46° 18', one berg; Straits of Belle Isle, twenty large bergs and innumerable small pieces of ice.

19th.—N. 45° 46', W. 46° 00', a large berg; N. 48° 09', W. 46° 45', a large berg, estimated one thousand feet long and four hundred feet high; N. 48° 30', W. 46° 51', a berg; N. 52° 40', W. 50° 00', a berg; one hundred and sixty-eight miles east-northeast from Belle Isle to twenty miles southwest

from Greenly Island, some very large bergs, one being the largest ever seen by the captain or officers on the Atlantic; N. 48° 46', W. 46° 54', a large berg with pieces awash; N. 48° 33', W. 47° 30', a berg; N. 48° 20', W. 48° 02', a large berg; N. 46° 42', W. 47° 11', a small berg; N. 52° 44', W. 51° 50', several large and small bergs; from this position to N. 51° 09', W. 57° 25', on the 20th, large and small bergs, and numerous bergs about Belle Isle and in the straits; N. 52° 36', W. 53° 00', from this position to Belle Isle, a large number of bergs,

20th.—Belle Isle, five bergs; N. 46° 04', W. 45° 44', two bergs, one about one hundred and fifty feet, and the other about four hundred feet high; from Belle Isle through the straits, a number of very large bergs, many aground; N. 48° 45', W. 47° 40', a large berg; N. 55° 36', W. 45° 48', two bergs bearing north-northwest eight miles; N. 51° 13', W. 57° 10', three small bergs; passed several bergs, large and small, in the Straits of Belle Isle.

21st.—N. 52° 50', W. 52° 14', a large berg; N. 52° 15', W. 53° 40', a number of bergs, large and small; N. 48° 19', W. 47° 40', a large berg, partially obscured by fog.

23d.—N. 45° 27', W. 45° 33', a berg.

26th.—N. 52° 00', W. 54° 15', bergs of various sizes; Straits of Belle Isle thickly studded with bergs, reaching to forty-three miles west of Greenly Island, right in the track of vessels; a large number of bergs in the Straits of Belle Isle; also a large number to the eastward; the last one being about one hundred and sixty miles east-northeast of Belle Isle on 27th.

28th.—N. 47° 56', W. 46° 21', field of ice; N. 49° 05', W. 44° 01', six bergs of considerable size.

30th.—N. 47° 48', W. 45° 36', a piece of ice.

#### FOG IN JULY.

The limits of fog-belts west of the fortieth meridian are shown on chart i by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on eighteen dates, as compared with nineteen dates for June, 1889, and twenty-eight dates for July, 1888. Between the fifty-fifth and sixty-fifth meridians fog was reported on ten dates, as compared with eighteen dates for June, 1889, and thirteen dates for July, 1888. West of the sixty-fifth meridian fog was reported on eleven dates, as compared with fifteen dates for June, 1889,

and thirteen dates for July, 1888. Compared with the preceding month there has been a decrease in fog-frequency west of the fortieth meridian, the decrease being most marked south of Nova Scotia. Over and near the Grand Banks fog was reported with the approach or passage of areas of low pressure, save on the 30th and 31st, when high pressure and variable winds prevailed. South of Nova Scotia fog was noted with the approach or presence of areas of low pressure, except on the 3d, 30th, and 31st, when the winds were variable or southerly and the pressure high in that region. West of the sixty-fifth meridian the development of fog attended the presence over the Gulf or Valley of Saint Lawrence or the Canadian Maritime Provinces of areas of low pressure, except on the 2d, 3d, and 30th, when high pressure and southeast winds prevailed off the coast of the United States.

The following are limits of fog-areas on the north Atlantic Ocean during July, 1889, as reported by shipmasters:

Date.	Entered.			Cleared.			Date.	Entered.			Cleared.		
	Lat. N.	Lon. W.		Lat. N.	Lon. W.			Lat. N.	Lon. W.		Lat. N.	Lon. W.	
1	41 10	66 32		47 15	40 13		18-19	46 40	52 56		44 42	61 50	
2	42 22	60 55		40 40	67 40		19-20	51 56	55 05		Off Point Amour.		
3	42 22	65 17		42 30	61 30		19-20	Off Belle Isle.			Cape Norman.		
3	42 22	65 17		42 30	68 23		19-20	53 44	48 32		55 00	42 18	
3-5	46 52	52 18		Halifax.			20	40 51	68 16		40 47	68 40	
4-5	42 24	61 45		44 46	54 49		20	39 40	71 00		40 02	71 08	
4-5	52 38	48 12		Near Belle Isle.			20-21	46 05	45 04		45 48	50 13	
4-5	53 49	48 38		52 01	55 00		20-21	40 20	68 55		40 16	69 45	
5	53 18	52 44		52 38	53 08		20-21	46 49	52 25		45 32	50 53	
5	44 50	56 30		43 00	57 00		20-21	44 15	56 30		42 00	63 10	
5-6	42 28	48 57		42 12	51 01		21	42 26	64 10		42 26	65 50	
6	46 01	50 06		45 07	54 05		21-22	43 20	64 18		40 40	67 25	
6-7	48 10	48 15		46 55	48 30		21-22	53 37	51 31		54 00	49 50	
7	48 20	47 54		47 44	49 55		22-23	43 10	65 40		42 38	68 40	
7	43 27	49 58		43 26	50 27		22-23	41 05	67 00		40 35	69 45	
10-13	47 42	47 00		44 29	57 30		22-24	46 16	44 12		45 06	51 46	
11	43 30	44 30		43 20	49 20		23	45 02	45 40		44 10	48 58	
12	43 00	49 00		42 45	50 00		24-25	44 31	47 24		44 08	48 49	
13	40 58	67 50		40 49	70 17		25-26	42 00	52 50		41 00	55 15	
13-14	42 18	64 36		Off Cape Cod.			29	41 05	66 57		40 46	68 35	
13-14	41 27	65 55		40 42	70 35		29-30	42 46	64 58		42 28	68 24	
13-15	53 25	46 45		51 05	57 30		30	44 25	52 20		44 40	51 40	
14	40 41	68 54		40 45	72 00		30	43 00	61 10		42 35	66 20	
14-15	42 00	66 00		39 48	70 00		30	42 30	63 00		42 28	67 15	
15	45 30	53 40		46 20	52 00		30-31	48 00	47 30		47 35	52 03	
15	42 20	49 30		41 11	51 02		31	44 33	49 37		42 12	61 30	
16	41 41	49 37		41 42	50 03		31	53 36	48 00				
16	48 30	47 00		49 10	44 10								

#### TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for July, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

In July, 1889, the mean temperature was highest in the lower valley of the Colorado River, where, at stations in adjoining parts of Arizona, California, and Nevada the values rose above 95°, the highest mean reading, 99°.8, being reported at Volcano Springs, Cal. On the Atlantic coast south of the thirty-third parallel, over the southern half of the east Gulf states, along the Mississippi River to Kentucky, at stations in Indian Territory and eastern and southeastern Texas, and in areas in central Missouri, central Kansas, northern Utah, northern Nevada, and the valleys of the Sacramento and San Joaquin rivers, Cal., the mean temperature was above 80°. The mean temperature was lowest along the California coast north of San Francisco, where it was below 55°; in the lower Saint

Lawrence valley, the British Possessions north of Montana, the north Pacific coast, and at stations in central Colorado, it fell below 60°, and was below 70° north of a line traced from southwestern New England irregularly westward over the Lake region to the upper Missouri valley, thence southward to south-central New Mexico, north-northwest to northeastern Washington Territory, and at stations west of this line continued southward along the Pacific coast to southern California.

The departures from the normal temperature for the month were small. East of the Rocky Mountains the mean temperature was below the normal, except in Nova Scotia, the lower Saint Lawrence valley, the eastern part of the lower lake region, the northeastern portion of the upper lake region, in adjoining parts of Alabama, Georgia, Tennessee, and the Carolinas, and east-central and southeastern Texas, where the readings were slightly above the normal. The mean values were also below the normal in southern New Mexico and Arizona, in western California south of the thirty-ninth parallel, and on the Pacific coast north of the mouth of the Columbia River. In the Rocky Mountain and plateau regions, and on the Pacific coast between the thirty-ninth parallel and the Columbia River, the month was somewhat warmer than the average July.

Considered by districts, the greatest average departure below the normal temperature occurred on the southeastern slope of the Rocky Mountains, where it was 3°.4; in the Florida